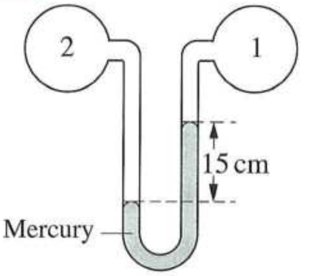
المراجعة رقم (1)

اختبار شهر مارس

March Test 1

First Choose the correct answer

1 In the opposite figure, if the pressure of the gas in container (2) is 50 cm Hg, the pressure of the gas in container (1) is ....

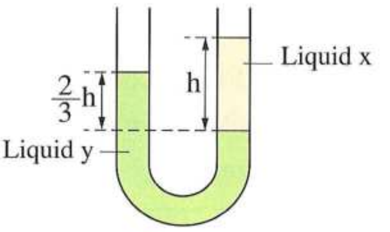


(a) 25 cm Hg (b) 35 cm Hg
(c) 45 cm Hg (d) 110 cm Hg

2 If the pressure of a contained gas in a tank is 2 atm, its pressure in the unit of m Hg equals .... (Where: $P_a = 76$ cm Hg)

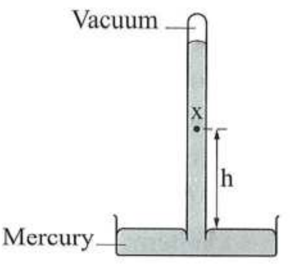
(a) 1.52 m Hg (b) 1.96 m Hg (c) 77.2 m Hg (d) 91.2 m Hg

3 The opposite figure shows a U-shaped tube of uniform cross-sectional area containing two liquids x and y at equilibrium, so the ratio between the mass of the column of liquid x to that of the column of liquid y above the level of the separating surface is ....



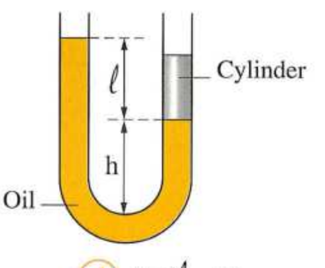
(a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) $\frac{1}{1}$ (d) $\frac{4}{9}$

4 The opposite figure shows a mercury barometer being used to determine the atmospheric pressure where it is found to be 75 cm Hg, so if the pressure at point x equals 46.648×10^3 N/m^2, height h equals ....
(Take: $\rho_{Hg} = 13600$ kg/m^3 , g = 9.8 m/s^2)



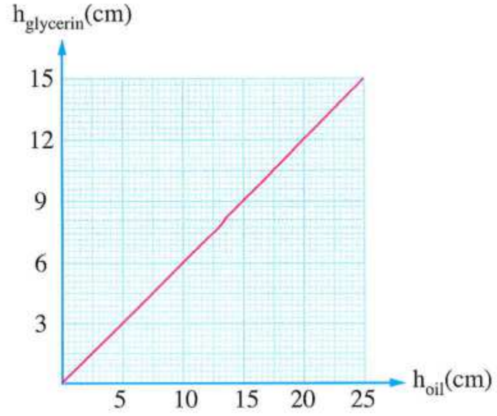
(a) 20 cm (b) 25 cm (c) 30 cm (d) 40 cm

5 The opposite figure shows a U-shaped tube of uniform cross-sectional area A. The tube is filled partially with oil of density ρ, then a solid tightly-fitted cylinder is put in the right arm of the tube to slide inside it, so if the system is balanced, the mass of the solid cylinder equals ....



(a) $A\ell\rho$ (b) $\ell^3\rho$ (c) $A\rho(\ell + h)$ (d) $A\rho(\ell - h)$

6 A U-shaped tube contains an amount of glycerin whose density is 1260 kg/m^3. Oil is poured gradually in one of the arms of the U-shaped tube and the opposite graph shows the relation between the height of oil and that of glycerin above the level of the separating surface between oil and glycerin at equilibrium, so the density of oil equals ....



(a) 672 kg/m^3 (b) 750 kg/m^3

(c) 756 kg/m^3 (d) 800 kg/m^3

7 An airplane flies at height of 2700 m above the Earth's surface. If the pressure inside the airplane equals the atmospheric pressure at the Earth's surface which is 76 cm Hg, the average density of air is 1.1 kg/m^3 and the density of mercury is 13600 kg/m^3, so the difference between the air pressure inside and outside the airplane equals .... (Take: g = 9.8 m/s^2)

(a) zero (b) 21.8 cm Hg (c) 2.5 cm Hg (d) 73.4 cm Hg

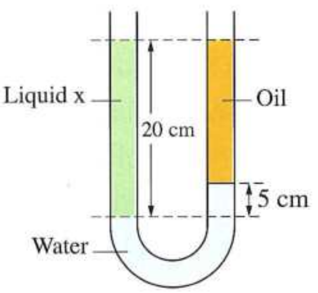
8 A gas reservoir, the difference between its pressure and the atmospheric pressure was 3.78 kPa, was connected to one of the arms of a manometer so that the height of the liquid column in the open arm of the manometer became 60 cm and the height of the liquid column in the arm connected to the reservoir became 30 cm, so using the opposite table, the liquid in that manometer was ....

(Where: g = 10 m/s^2)

Liquid	Density (kg/m^3)
Mercury	13600
Water	10^3
Glycerin	1260
Oil	800

(a) oil (b) water (c) mercury (d) glycerin

9 In the opposite figure, if the relative density of oil is 0.6, the relative density of liquid x is ....

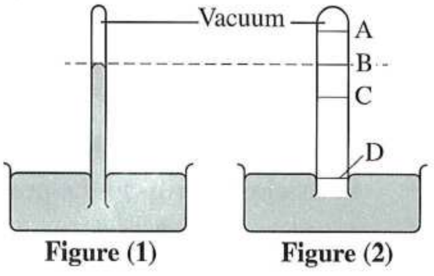


(a) 0.7 (b) 0.75

(c) 0.8 (d) 0.85

Second | Answer the following questions

10 The opposite figures show two mercury barometers that are placed next to each other. If the radius of the tube in figure (1) is less than the radius of the tube in figure (2). **Which level in figure (2) represents** the surface level of mercury? **Explain your answer.**



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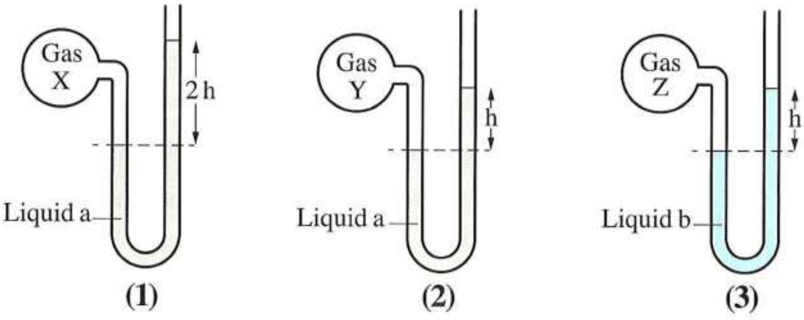
11 In the following figures, **which** of the gases X, Y or Z has the least pressure? **And why?** (Where: $\rho_a > \rho_b$)



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12 A U-shaped tube contains an amount of water, the cross-sectional area of one of its arms is double that of the other arm. When oil is poured into the wider arm, the level of water in it gets lowered by 3 cm. **Calculate** the height of the oil above the level of the separating surface.

(Where: the density of oil = 900 kg/m^3, the density of water = 1000 kg/m^3)

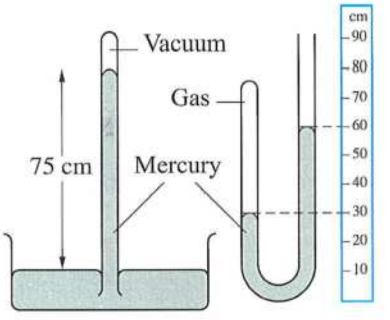
....

....

March Test 2

First Choose the correct answer

1. The opposite figure shows a barometer placed beside a mercury manometer that enclosing an amount of gas in its closed arm, so the pressure of the enclosed gas in the manometer equals ………………… .



(a) 45 cm Hg (b) 75 cm Hg
(c) 105 cm Hg (d) 135 cm Hg

2. If the readings of a mercury barometer at the ground floor and at the uppermost floor of a building of height 150 m are 76 cm Hg and 74.6 cm Hg respectively, then the average density of air between the two floors is ………………… . (Where: $\rho_{Hg} = 13600\ kg/m^3$)

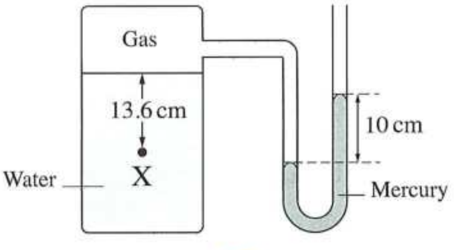
(a) $1.20\ kg/m^3$ (b) $1.23\ kg/m^3$ (c) $1.27\ kg/m^3$ (d) $1.29\ kg/m^3$

3. A U-shaped tube of uniform cross-section has a height 36 cm. Water is poured in the tube till its height reached to the two thirds of the height of the tube. If a liquid of relative density 0.8 is poured in one arm till it has reached the edge of the tube at equilibrium, so the height of water above the level of the separating surface is ………………… .

(a) 8 cm (b) 12 cm (c) 14 cm (d) 16 cm

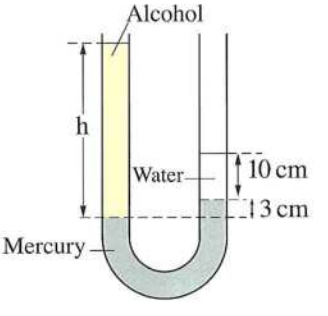
4. A mercury manometer is connected to a tank containing an amount of water as shown in the opposite figure, so the pressure at point X is ………………… .

(Where: $\rho_{Hg} = 13.6\ \rho_{water}$, $P_a = 76$ cm Hg)



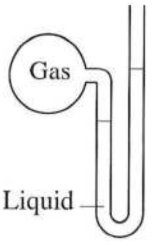
(a) 77 cm Hg (b) 78 cm Hg (c) 87 cm Hg (d) 91 cm Hg

5. In the opposite figure, if the density of alcohol, mercury and water are $750\ kg/m^3$, $13600\ kg/m^3$ and $1000\ kg/m^3$ respectively, so the height of the alcohol column above the separating surface is approximately ………………… .



(a) 20.3 cm (b) 30.4 cm
(c) 40.5 cm (d) 67.7 cm

6 A manometer is being used to measure the pressure of an enclosed gas in a tank as shown in the opposite figure, so the pressure of the gas inside the tank is ....



(a) equal to the atmospheric pressure
(b) greater than the atmospheric pressure
(c) less than the atmospheric pressure
(d) equal to zero

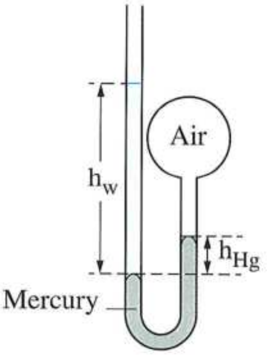
7 Two mercury barometer tubes are placed in one mercury basin, the cross-sectional area of the first tube is half that of the second, then the ratio between the heights of mercury columns in the two tubes above the surface of mercury in the basin respectively is ....

(a) $\frac{2}{1}$ (b) $\frac{1}{1}$
(c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$

8 A vertical U-shaped tube of height 28 cm has two arms of cross-sectional areas 2 A and 3 A. It is filled with water to its half, then oil of density 750 kg/m^3 is poured in its wide arm till it has reached the edge at equilibrium, so the height of water above the level of separating surface with oil will be .... (Take: $\rho_w = 1000\ kg/m^3$)

(a) 5 cm (b) 10 cm
(c) 15 cm (d) 20 cm

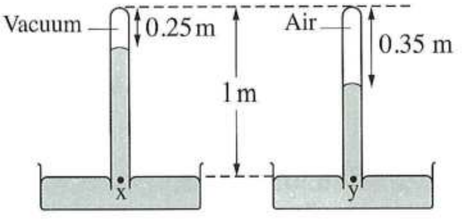
9 A quantity of water is poured into the open arm of a mercury manometer as shown in the opposite figure, so the pressure of the enclosed air equals ....



(a) $P_a + g\rho_w h_w + g\rho_{Hg} h_{Hg}$
(b) $P_a + g\rho_w h_w - g\rho_{Hg} h_{Hg}$
(c) $g\rho_w h_w + g\rho_{Hg} h_{Hg}$
(d) $g\rho_w h_w - g\rho_{Hg} h_{Hg}$

Second Answer the following questions

10 The opposite figure shows two mercury barometers being placed at sea level;



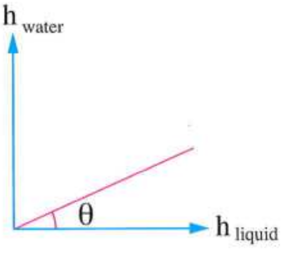
(a) **Are** the pressures at the two points x and y equal? **Explain your answer**.

(b) **What** is the pressure of the trapped air in the unit of mm Hg?

....

....

11 A U-shaped tube contains a quantity of water. Another liquid is poured gradually in one of its arms. The opposite graph shows the relation between the height of water and the height of the other liquid above the separating surface at equilibrium. **Find** the relative density of the liquid in terms of θ, given that the two axes are drawn with the same scale.



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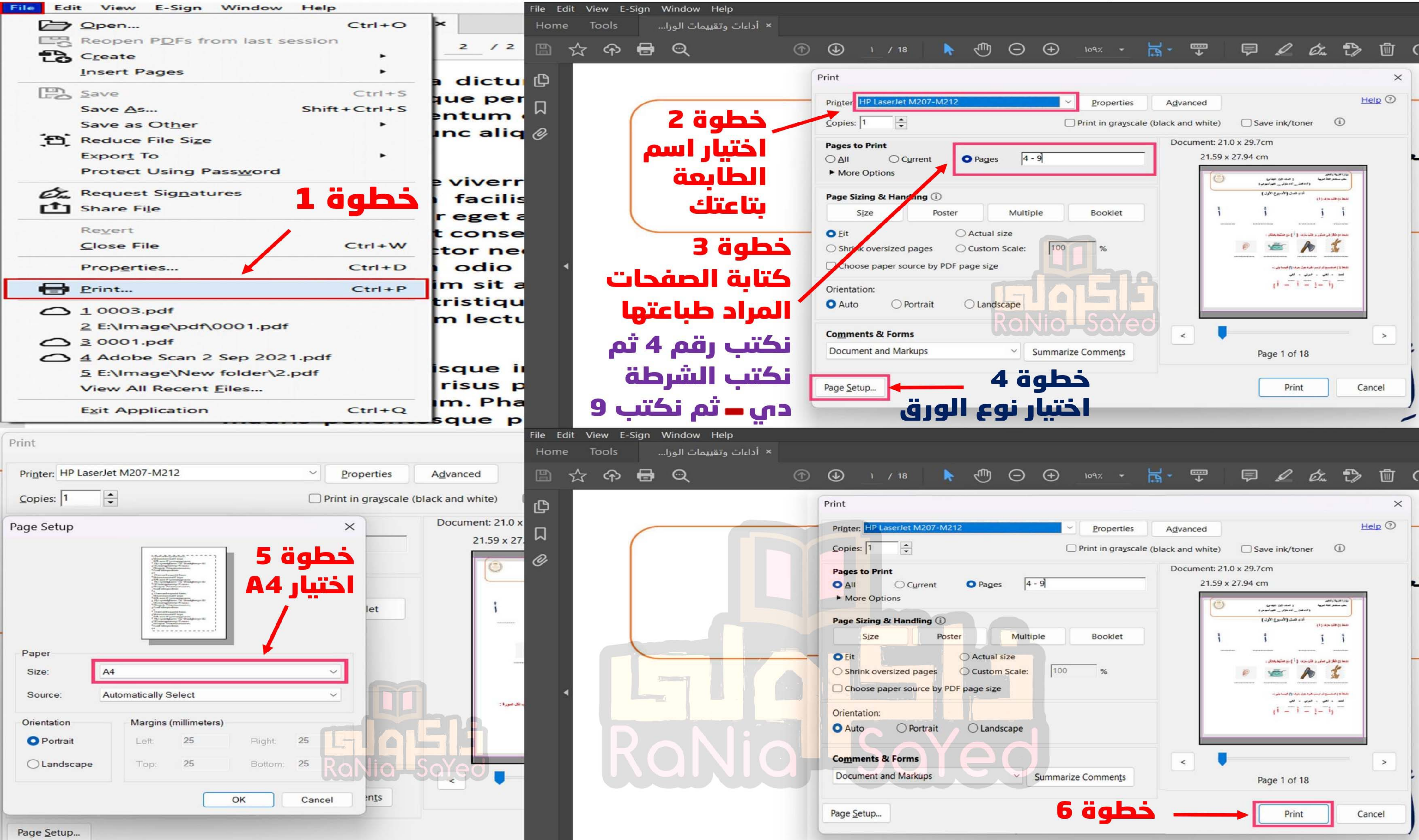
12 **When does** the height difference of the liquid levels in the arms of a manometer connected to a gas tank equal zero?

....

....

كيفية طباعة صفحات معينة من ملف معين

مثلا ازاى نطبع الصفحات من صفحة 4 الى صفحة 9



المراجعة رقم (2)

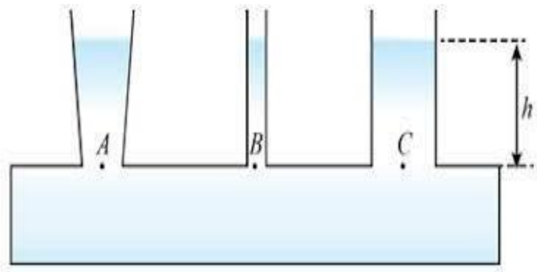
اختبار شهر مارس

Applications on the pressure at a point inside the liquid

1) Connected vessels   2) U-shaped tube

3) Mercuric barometer   4) Manometer

1-Connected vessels:



- Structure: Container consists of many vessels of different geometrical shapes connected at its base.

- Idea of work:

Pressure at all points in the same horizontal plane in a liquid is the same.

- SO $P_A = P_B = P_C$

2) U-shaped tube:

- Idea of work: Pressure at all points in the same horizontal plane in a liquid is the same.

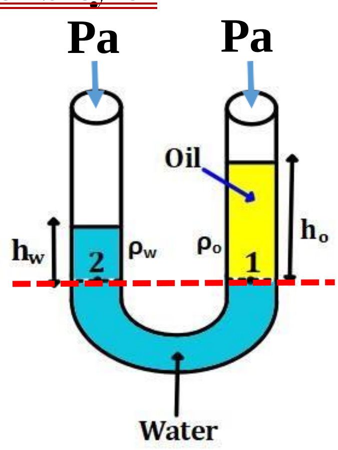
-Uses:

1-Comparing the density of the two liquids.

2-Determining the density of a liquid by knowing the density of another liquid.

3-Determining the relative density of a liquid that doesn't mix with water (immiscible liquid).

★Determination of the density of oil by knowing the density of water using U-shaped tube:



∵points (1) and (2) at the same horizontal plane

∴ $(P_1) = (P_2)$

∴ $P_a + \rho_o g h_o = P_a + \rho_w g h_w$

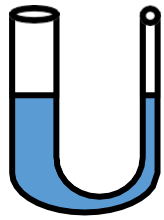
∴ $\rho_o h_o = \rho_w h_w$

$$\therefore \frac{\rho_o}{\rho_w} = \frac{h_w}{h_o}$$

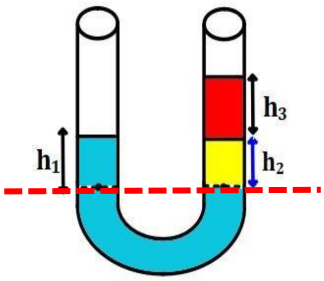
- $\left(\frac{\rho_o}{\rho_w}\right)$ **is the relative density of oil.**

★Notes:

1)The height of the liquid in the tube is inversely proportional to its density $(h \propto \frac{1}{\rho})$.



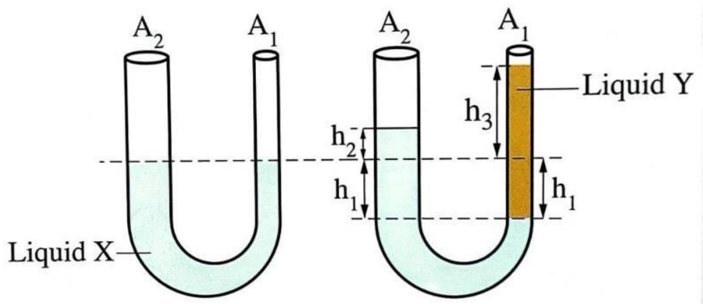
2) Radius of the tube doesn't affect the height of the liquid in the sides of the tube.
So, we can apply the relation ($\rho_1 h_1 = \rho_2 h_2$) in U-shaped tube with different diameter.



3) In case of miscible liquids, they can be separated by a third liquid that is immiscible with each of them like mercury which can separate water and alcohol.

$$\rho_1 h_1 = \rho_2 h_2 + \rho_3 h_3$$

4) When pouring an amount of liquid X in a U-shaped tube whose arms have cross-sectional areas A_1 ,A_2 , then an amount of another liquid Y is added in one of its arms, the surface of liquid X in this arm gets lowered down a distance h_1 and it rises in the other arm a distance h_2 and at all times:



(1) The volume of the liquid which is displaced downward ($A_1 h_1$) = The volume of the liquid which is displaced upward ($A_2 h_2$)

(2) The height of liquid X that is displaced upward in the tube above the level of the interface between the two liquids $h_x = h_1 + h_2$

(3) The height of liquid Y above the level of the interface: $h_y = h_1 + h_3$

(4) At the level of the interface: $\rho_x h_x = \rho_y h_y$

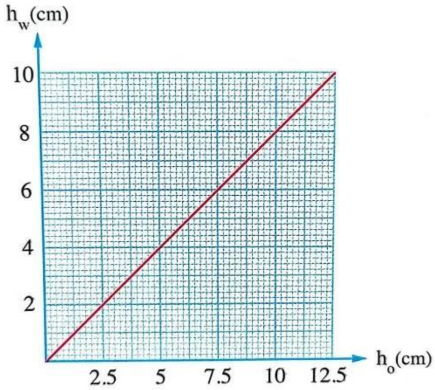
Class Sheet

1- A U-shaped tube of uniform cross-sectional area is partially filled with water of density 1000 kg/m^3, then oil of density 800 kg/m^3 is poured in one of its arms until the height of oil column becomes 5 cm above the separating surface at equilibrium, then the height of water above the level of the separating surface is…………

a) 2 cm b) 4 cm

c) 5 cm d) 8 cm

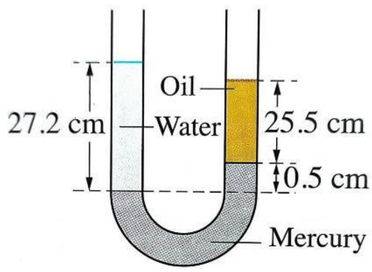
2- A U-shaped tube was containing an amount of water, then oil is poured gradually in one of its arms. If the opposite graph shows the relation between the height of oil (h_o) in one arm and the height of water in the other arm (h_w) above the level of the boundary surface between the two liquids, then the relative density of oil equals………….



a) 0.6 b) 0.7

c) 0.8 d) 1.25

3- In the opposite figure, a U-shaped tube of uniform cross- section contains three immiscible liquids in a state of equilibrium. If the relative density of mercury is 13.6, then the relative density of oil is ………..



a) 0.6 b) 0.8

c) 0.85 d) 1.25

4- A U-shaped tube of uniform cross-section whose vertical height is 50 cm, is filled to half its height with water, then oil is poured in one of its arms until it has reached the top edge of that arm, if the density of oil is 750 kg/m^3 and the density of water is 1000 kg/m^3 then the height of oil will be............

a) 15 cm b) 30 cm

c) 35 cm d) 40 cm

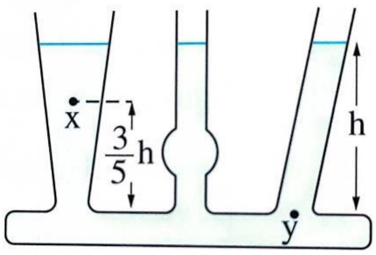
5- **A U-shaped tube of height 60 cm is placed vertically. The cross-sectional area of one of its arms is double that of the other. It is filled until half its height with water, then oil of density 600 kg/m³ is poured in the narrow arm until it has reached the top edge of the tube, then the height of water above the level of the interface between the two liquids is** ....($\rho_{water} = 1000\ Kg/m^3$)

a) 10 cm　　　　b) 11.25 cm

c) 12.86 cm　　　　d) 30 cm

Homework

1- The opposite figure shows a number of connected vessels that contain a liquid of density ρ. If the pressure of the liquid at point y is P, the pressure of the liquid at point x equals ....



a) $\frac{2}{3}$ p　　　　b) $\frac{1}{3}$ p

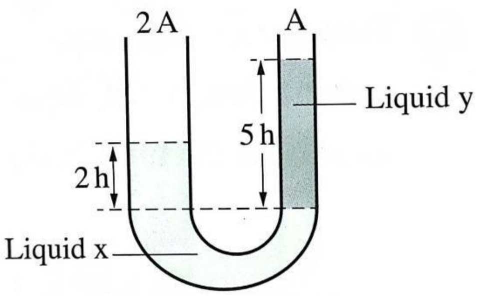
c) $\frac{3}{5}$ p　　　　d) $\frac{2}{5}$ p

2- A U-shaped tube contains an amount of water of density 10^3 kg/m^3, then an amount of oil of density 875 kg/m³ is poured in one of its arms, if the height of oil column is 10 cm, the height of water column above the level of the interface with water which balances the oil's column is.....

a) 7.58 cm　　　　b) 7.85 cm

c) 8.75 cm　　　　d) 9.25 cm

3- The opposite figure shows two immiscible liquids x, y which are at an equilibrium state in a U-shaped tube, so the ratio between the densities of the two liquids $(\frac{\rho_x}{\rho_y})$ **is...........**



a) $\frac{1}{2}$　　　　b) $\frac{2}{5}$

c) $\frac{5}{2}$　　　　d) $\frac{2}{1}$

4- An oil of relative density 0.8 is poured in one of the arms of a U-shaped tube of uniform cross-sectional area that contains an amount of water, then the height difference between the levels of oil and water is.................. the height of water above the level of separating surface.

a) $\frac{1}{4}$ b) $\frac{1}{5}$

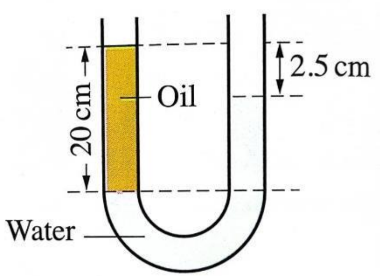
c) $\frac{1}{2}$ d) $\frac{2}{5}$

5- A U-shaped tube contains water of density 10^3 kg/m³, after pouring oil in one of its two branches the height difference between the water surfaces in the two branches becomes 19 cm, then if the oil density is 800 kg/m³, the height of oil equals.........

a) 21.25 cm b) 21.75 cm

c) 22.5 cm d) 23.75 cm

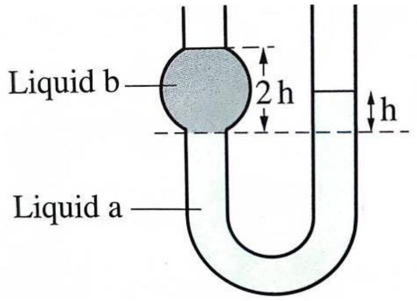
6- In the opposite figure, an amount of water of density 1000 kg/m³ is poured in one of the arms of a U-shaped tube, then an amount of oil is added. If the liquids become in equilibrium, then the density of oil is………



a) 800 Kg/m^3 b) 875 Kg/m^3

a) 900 Kg/m^3 b) 950 Kg/m^3

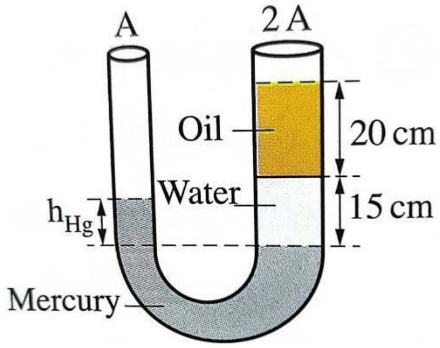
7- In the opposite figure, a U-shaped tube containing two liquids a, b, so the ratio between the densities of the liquids ($\frac{\rho_a}{\rho_b}$) is…………….



a) $\frac{1}{2}$ b) $\frac{1}{4}$

c) $\frac{2}{1}$ d) $\frac{4}{1}$

8- In the opposite figure, a U-shaped tube contains three immiscible liquids in equilibrium, so the height of mercury (h_{Hg}) above the level of interface between water and mercury is nearly...........

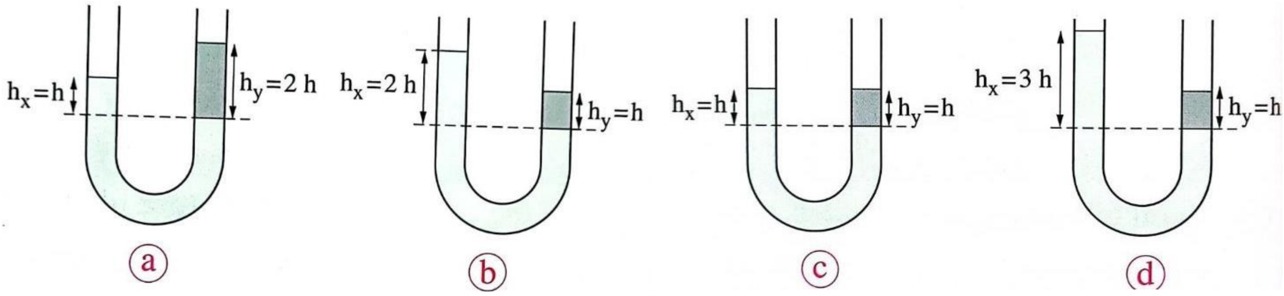


(Take: ρ_o = 850 Kg/m³, ρ_w = 1000 Kg/m³ , ρ_{Hg} = 13600 Kg/m³)

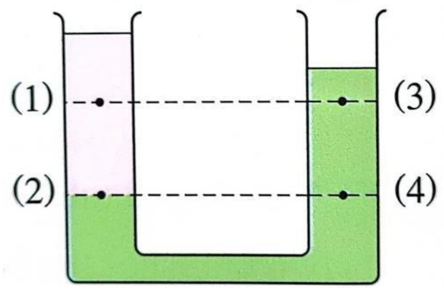
a) 4.15 cm b) 3.75 cm

c) 3.25 cm d) 2.35 cm

9- Two immiscible liquids x and y are put in a U-shaped tube. If the density of liquid x is 2 ρ and the density of liquid y is ρ, which of the following choices represents the positions of liquids in the tube at equilibrium?



10- In the opposite figure, a U-shaped tube contains two immiscible liquids in a state of equilibrium, then which of the following ratios for the pressure at points 1 , 2 , 3 , 4 is greater than one?



a) $\frac{P1}{P4}$ b) $\frac{P2}{P4}$

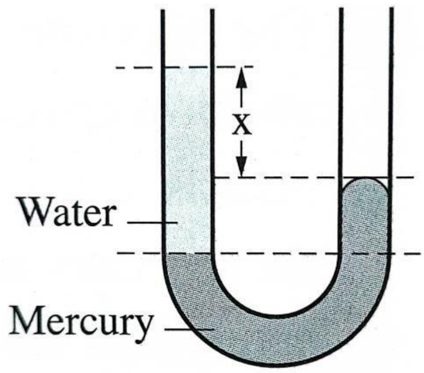
c) $\frac{P1}{P3}$ d) $\frac{P3}{P2}$

11- A U-shaped tube of uniform cross-section of height 30 cm is placed vertically, then gets filled with water up to its half. Oil is poured in one of its arms till the edge, then if the oil density is 800 kg/m³ and water density is 1000 kg/m³, the water height above the separating surface is…………

a) 10 cm b) 15 cm

c) 20 cm d) 25 cm

12- The opposite figure shows a U-shaped tube of uniform cross-sectional area of 1cm² When two equal volumes of water and mercury, each of value 20 cm³ are poured into the U-shaped tube, they become in equilibrium state as shown in the figure, then the height difference (x) between the levels of the two liquids in the arms of the tube equals……………

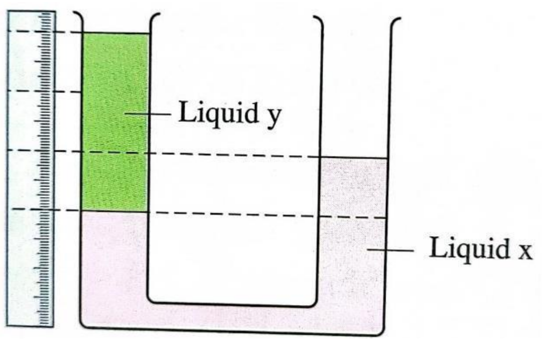


(ρ_w = 1000 Kg/m³ , ρ_{Hg} = 13600 Kg/m³)

a) 21.47 cm b) 20 cm

c) 19.14 cm d) 18.53 cm

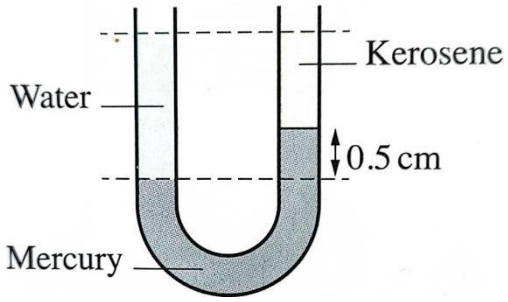
13- In the opposite figure, a vertically oriented U-shaped tube contains two immiscible liquids in a state of equilibrium, then the ratio between the densities of the two liquids $(\frac{\rho_x}{\rho_y})$ equals……



a) $\frac{2}{1}$ b) $\frac{3}{1}$

c) $\frac{4}{1}$ d) $\frac{5}{1}$

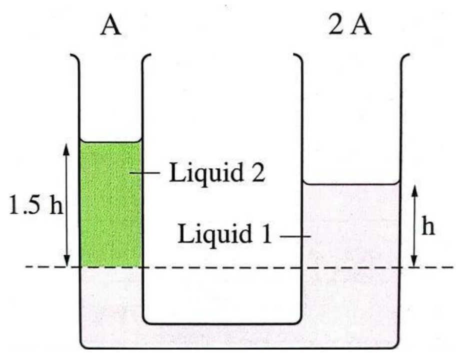
14- The opposite figure shows a U-shaped tube containing three immiscible liquids at equilibrium, then the height of water column equals……… **(Take: $\rho_{kerosene} = 800$ Kg/m³, $\rho_w = 1000$ Kg/m³ , $\rho_{Hg} = 13600$ Kg/m³)**



a) 17.2 cm b) 24 cm

c) 32 cm d) 36 cm

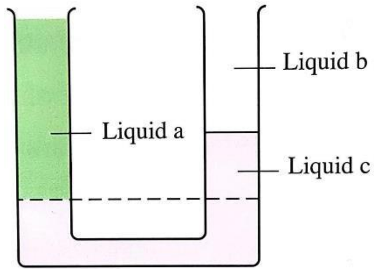
15- The opposite figure shows a U-shaped tube containing two immiscible liquids at equilibrium, then the ratio between the masses of the two liqui ds $(\frac{m_1}{m_2})$ above the separating surface equals…………..



a) $\frac{3}{2}$ b) $\frac{2}{1}$

c) $\frac{2}{3}$ d) $\frac{4}{3}$

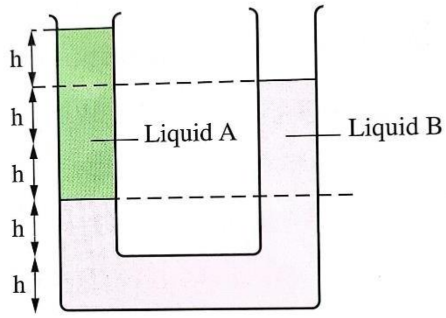
16- The opposite figure shows a U-shaped tube containing three immiscible liquids a, b, c at equilibrium, then the correct order for their densities is……….



a) $\rho_a > \rho_b > \rho_c$ b) $\rho_a < \rho_b > \rho_c$

c) $\rho_c > \rho_a > \rho_b$ d) $\rho_c > \rho_b > \rho_a$

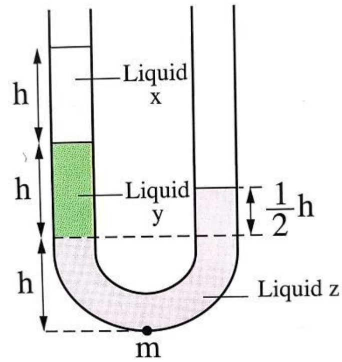
17- The opposite figure shows a U-shaped tube containing two immiscible liquids A, B of densities 600 kg/m^3 and ρ respectively, then the value of ρ is…………………



a) 400 kg/m^3 b) 800 kg/m^3

c) 900 kg/m^3 d) 1200 kg/m^3

18- A U-shaped tube containing three immiscible liquids (x, y, z) at equilibrium where their levels are as shown in the opposite figure. If the density of liquid y is double that of x and pressure of liquid x equals P. then the pressure due to the three liquids at point m equals.................



a) 3 P b) 6 P

c) 9 P d) 12 P

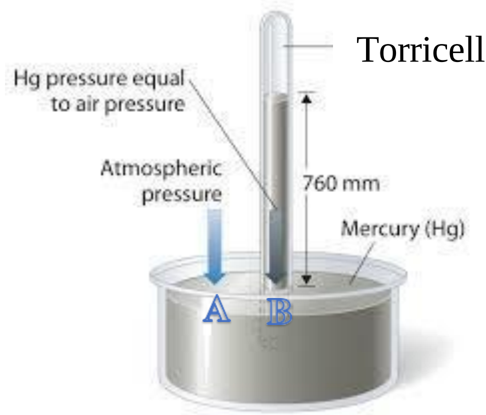
19- A U-shaped tube of uniform cross-section of area 5 cm^2 contains an amount of mercury. An amount of glycerin is added in one of its arms, so the height of glycerin column above the interface with mercury becomes 10 cm, so the mass of water which is required to be poured in the other arm to make the surfaces of mercury in both arms at the same level equals…………..

(Where: water density = 1000 kg/m^3, glycerin density = 1260kg kg/m^3, and mercury density = 13600 kg/m^3)

a) 0.063 kg b) 0.63 kg

c) 0.087 kg d) 0.163 kg

3- Mercuric barometer:



*Structure: A glass tube of length (1m) is completely filled with mercury then turned upside down in a tank of mercury.

*Its idea: Pressure at all points in the same horizontal plane in a liquid is the same.

Points (A) and (B) are in the same plane.

∴ $P_A = P_B$,Where

P_A = Atmospheric pressure (Pa)

P_B = The pressure due to the weight of the mercury column, its height = 760 mm.

Torricelli Vacuum

The space above the mercury inside the tube of the mercuric barometer that is evacuated except a few of mercury vapor.

The atmospheric Pressure:

It is the weight of air column whose base is the unit area and its height extends from the sea level to the top of the atmosphere. (OR)

It is the air pressure at sea level which is equivalent to the pressure due to weight of mercury column of height 0.76 m and of base 1 m^2 at 0 °C.

★G.R: 1) Mercury is used as a barometric substance.

Because the density of mercury is high so its height become suitable to the length of the barometer tube where ($h \propto \frac{1}{\rho}$).

2) Water can't be used instead of mercury in the barometer.

Because the density of water is much less than that of mercury. So, if water is used then the length of the tube of the barometer must be greater than 10 meters.

3) Mercury height in the barometer is not affected by the cross-sectional area of the barometric tube.

Because according to the relation ($P= \rho g h$) height of mercury in the barometric tube depends on the mercury density only.

★Factors affect the reading of the mercuric barometer:

1- Temperature of atmosphere.
2- Height from the sea level.

★W.D: Torricelli vacuum disappear in the barometric tube?

When the vertical height of the tube from the mercury level is less than or equal 76 cm.

★Uses of the mercuric barometer:

1- Determination of the atmospheric pressure.
2- Determination of the height of a mountain or a building.
3- Determination of the density of air.

$$\rho_{Hg}\,(h_1-h_2) = \rho_{air}\, h_{mountain}$$

Where:

(h_1) height of mercury at sea level.

(h_2) height of mercury above the mountain.

★Factors affecting the atmospheric pressure:

1-Height of the point from the sea level.

2-Temperature

3-Acceleration due to gravity

4- The density of atmospheric air

★Measuring units of atmospheric pressure:

atm , N/m^2 , Pascal , Bar , Cm Hg , Torr

The Values of the atmospheric pressure by different units

1 atm = 1.013×10^5 N/m^2 = 1.013×10^5 Pascal

) ∴ 1 N/m^2 = 1 Pascal)

1 atm = 1.013 Bar (∴ 1 bar = 10^5 N/m^2)

1 atm = 76 Cm Hg

76 Cm Hg = 760 mmHg = 0.76 m Hg =760 Torr (∴ 1 mm Hg = 1 Torr)

★ To convert the atmospheric pressure from unit to another:

$$\text{Pressure in the required unit} = \frac{\text{The quantity to be converted} \times \text{Atmospheric pressure in the required unit}}{\text{Atmospheric pressure in the original unit}}$$

★ W.H:

1) If the barometer is transferred to the top of a mountain concerning to height of mercury column.

The height of mercury decreases due to the decrease of the atmospheric pressure as we go higher.

2) If the cross-sectional area of the barometric tube increases concerning to the height of mercury column.

The height of mercury doesn't change because it doesn't depend on the cross-sectional area of the tube.

Class Sheet

1- If the pressure of an enclosed gas is 152 cm Hg, then its pressure in bars equals…………

a) 1.013 b) 2.026

c) 3.039 d) 4.052

2- If the pressure at a point inside a liquid is 1000 torr, then this pressure in pascal equals……

a) 1.013×10^5 b) 1.13×10^5

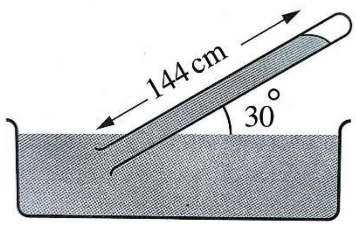
c) 1.33×10^5 d) 1.93×10^5

3- If oil is used instead of mercury in the barometer, then the height of oil column in the barometer tube at the standard atmospheric pressure is .... (Where: the density of oil = 800 kg/m^3, the density of mercury = 13600 kg/m^3)

a) 12.92 m b) 13.78 m

c) 18 m d) 21.6 m

4- The opposite figure shows a mercury barometer measuring atmospheric pressure. If the tube of the barometer is inclined to the horizontal by 30° then the measured atmospheric pressure equals (Where g = 9.8 m/s^2 , ρ_{Hg} =13600 kg/m^3)



a) 9.6×10^4 N/m^2 b) 1.013×10^5 N/m^2

c) 1.92×10^5 N/m^2 d) 3.86×10^5 N/m^2

5- If the reading of a mercury barometer at sea level is 76 cm Hg and its reading at the top of a mountain is 60 cm Hg, then given that the average density of air is 1.25 kg/m^3 and that of mercury is 13600 kg/m^3 the height of the mountain above sea level equals...........

a) 1741 m b) 1856 m

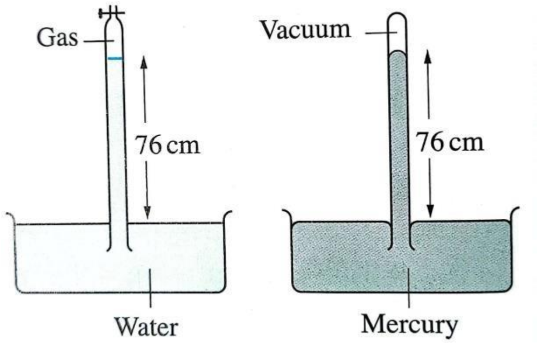
c) 3216 m d) 6528 m

6- **From the opposite figure, the pressure of the gas trapped by the water column equals…………**

(Where g = 9.8 m/s^2 , ρ_{Hg} =13600 kg/m^3 , ρ_w = 1000 kg/m^3)

a) 23.7×10^3 N/m^2 b) 46.92×10^3 N/m^2

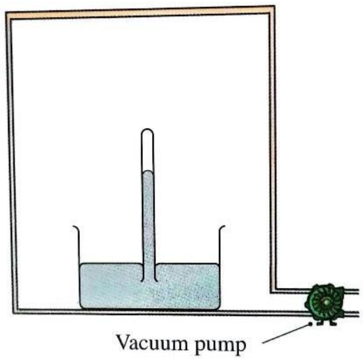
c) 93.84×10^3 N/m^2 d) 187.68×10^3 N/m^2



7- Consider that a mercury barometer is placed in a well sealed chamber that is getting evacuated partially from air gradually using a vacuum pump, then the Torricellian space inside the barometer tube…………

a) increases b) decreases but does not vanish

c) does not change d) decreases till vanishes

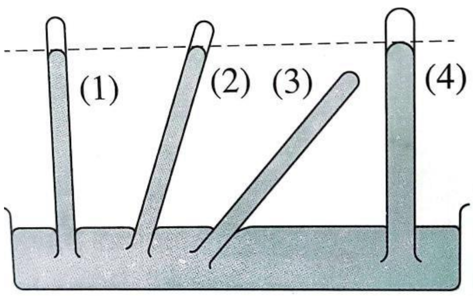


Homework

1- Four barometer tubes have been filled with mercury. then upturned in an open mercury filled basin as shown in the figure, in which of these tubes the height of mercury column is not representing the atmospheric pressure?

a) (1) b) (2)

c) (3) d) (4)



2- The mercury height inside the tube of the mercury barometer decreases when…………

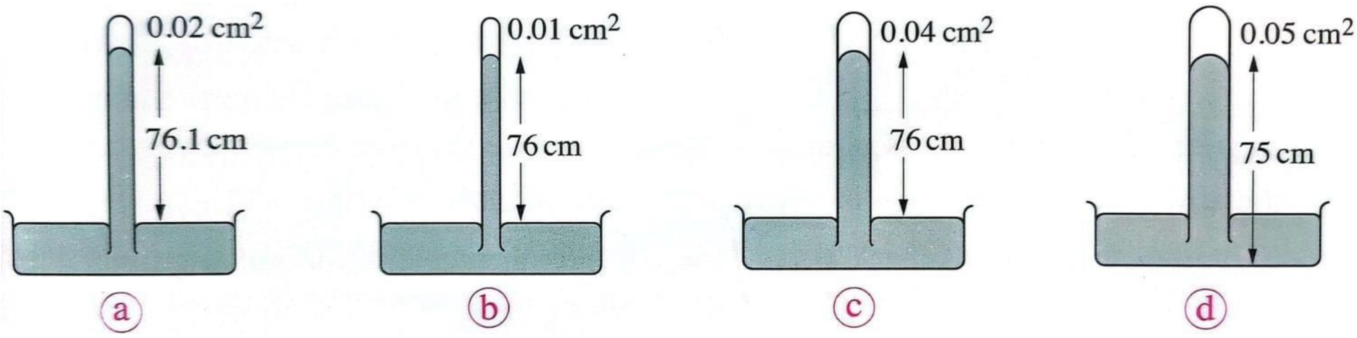
a) the amount of mercury in the basin increases

b) the cross-sectional area of the tube increases.

c) the barometer is transferred to the top of a high mountain

d) using a longer tube

3- In the following figure, four mercury barometers which are different in the cross-sectional area of their tubes are used to measure the atmospheric pressure in four different places at the same temperature. In which of them the barometer reads the least value of atmospheric pressure?



4- The presence of a small amount of air in the space above the mercury in the barometer tube leads to the decrease of mercury level inside the tube, because air molecules…………..

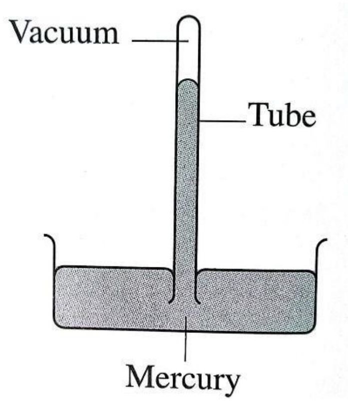
a) cool down the mercury so it contracts

b) heat up the mercury so it expands

c) prevent the evaporation of mercury in the tube

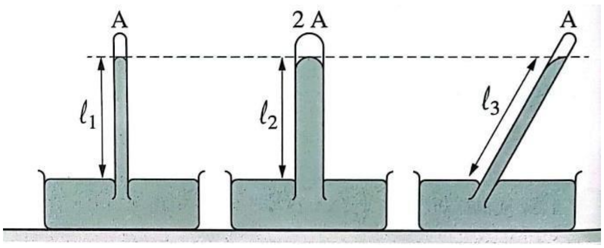
d) increase the pressure on the surface of mercury in the tube

5- The opposite figure shows the reading of a mercury barometer at the top of a mountain. If the barometer is transferred to the bottom of the mountain, then the level of the mercury surface…….



	In the barometer basin	In the barometer tube
(a)	increases	increases
(b)	decreases	decreases
(c)	increases	decreases
(d)	decreases	increases

6- The opposite figure shows three mercury barometers placed in the same room in the same horizontal level, then the relation between the lengths of the mercury columns from the surface of mercury in the basin to its surface inside the tube in each case is…………



a) $\ell_1 < \ell_2 < \ell_3$ b) $\ell_1 < \ell_2 = \ell_3$

c) $\ell_1 < \ell_2 > \ell_3$ d) $\ell_1 = \ell_2 < \ell_3$

7- Two adjacent mercury barometers (x, y) have cross-sectional areas 1 cm^2 , 2 cm^2 respectively, so the ratio between the height of mercury column in the tube of barometer x to the height of mercury column in the tube of barometer y $(\frac{h_x}{h_y})$ is……….

a) $\frac{1}{1}$ b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{4}{1}$

8- The approximate mass of an air column that extends from the sea level to the end of the atmosphere with cross-sectional area 1 cm^2 equals........... (Given that: the atmospheric pressure = 10^5 pascal, acceleration due to gravity = 10 m/s^2)

a) 0.01 kg b) 0.1 kg

c) 1 kg d) 2 kg

9- If the reading of a mercury barometer is decreased due to a storm by 20 mm from the standard atmospheric pressure, then the value of the atmospheric pressure in pascal in this case equals… ....(Given that: ρ_{Hg} = 13600 kg/m^3, Pa = 1.013 × 10^5 N/m^2 ,g = 9.8 m/s^2)

a) 24.65 × 10^3 pascal b) 49.3 × 10^3 pascal

a) 9.86 × 10^4 pascal a) 19.72 × 10^4 pascal

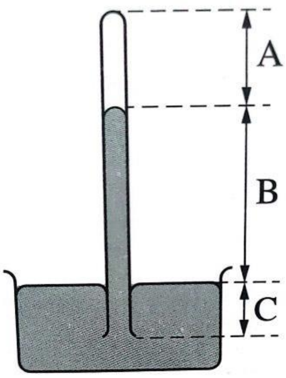
10- The reading of a mercury barometer at the highest point of a building of height 200 m was 74 cm Hg, then the reading of the barometer at the Earth's surface equals…………

(Given that: average density of air = 1.3 kg/m^3 , ρ_{Hg} =13600 kg/m^3)

a) 74.8 cm Hg b) 75.9 cm Hg

c) 76.8 cm Hg d) 76.5 cm Hg

11- The opposite figure shows a mercury barometer:



(i) Which of the shown distances decreases by increasing the atmospheric pressure?

a) A only b) B, C

c) C only d) A.C

(ii) If air is leaked to the upper part of the tube then the height (B) of mercury column inside the tube…………

a) decreases b) vanishes

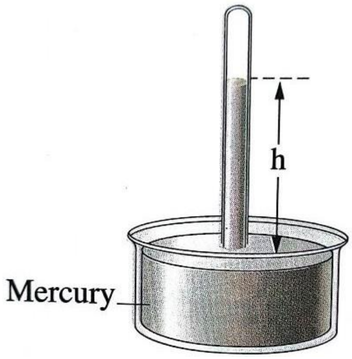
c) increases d) remains constant

12- A mercury barometer, whose tube is vertically oriented with a height of 1 m above the mercury surface in the basin, shows a reading of 76 cm Hg at the bottom of a mountain and when it gets transferred to the top of the mountain, its reading has changed by 4 cm Hg. so the ratio of Torricellian space length at the bottom of the mountain to its length at the top is…………

a) $\frac{7}{6}$ b) $\frac{6}{7}$

c) $\frac{1}{1}$ d) $\frac{4}{1}$

13- The reading of a mercury barometer was 0.71 m Hg at the sea level and 0°C, so the probable reason for this reading is………..



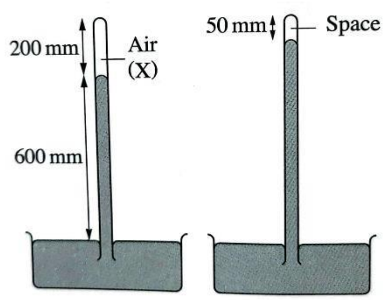
a) the presence of a space of length 3 cm above mercury

b) the spilling of some mercury outside of the basin

c) the leaking of an air bubble to the inside of the tube

d) the atmospheric pressure at these conditions is 0.71 m Hg

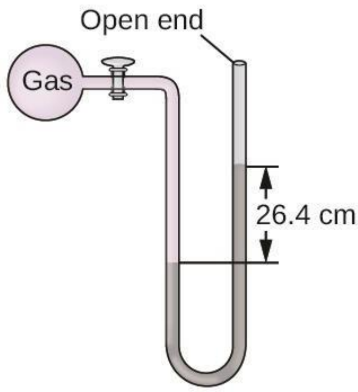
14- Two mercury barometers are identical, however, one of them has a vacuum space above the mercury level inside its tube while the other has air with the heights that are as shown in the figure, then the pressure of air (X) equals…………..



a) 40 mm Hg b) 50 mm Hg

c) 150 mm Hg d) 180 mm Hg

4) Manometer:



*Structure:

U-Shaped tube containing proper amount of liquid of known density. One of its ends is connected to the gas reservoir and the other end exposed to air.

*Types:

1) Aqueous manometer (The liquid used is water).

Used to measure small pressure of enclosed gas

2) Mercuric manometer (The liquid used is mercury).

Used to measure high pressure of enclosed gas

*Idea of working:

Pressure at all points in the same horizontal plane in a liquid is the same.

*Uses:

1) Measuring the pressure of enclosed gas

2) Measuring the difference between the pressure of enclosed gas and the atmospheric pressure.

★ G.R:

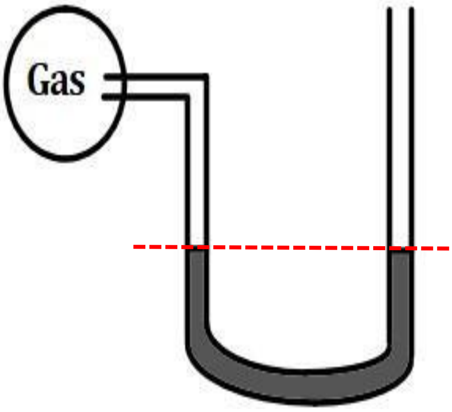
1) The aqueous manometer is preferred to the mercuric one to measure small pressure difference.

Because the density of water is small compared to that of mercury so the difference in water levels in the two branches become more clear and easy to be measured and error decreased.

2) It is preferable to use the mercuric manometer for measuring high pressure difference.

Because the mercury has high density, so mercury neither rush out the tube nor into the gas reservoir.

-How manometer is used ?

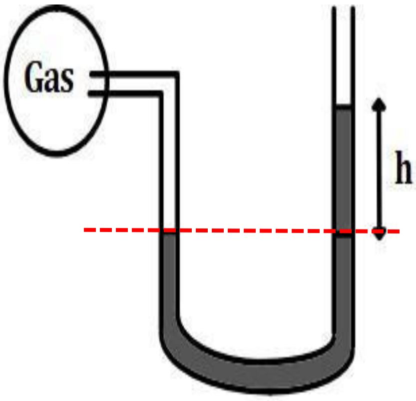


-In this case:

$P_a = P_{gas}$

$\Delta P = P_{gas} - P_a = \text{zero}$

$\Delta P = \text{zero}$

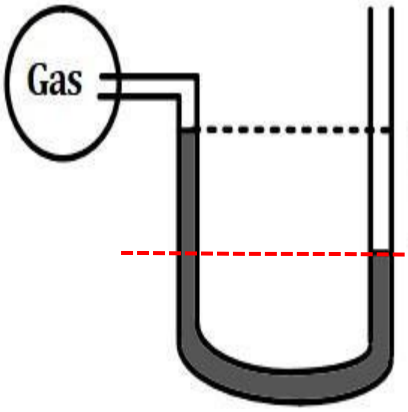


$P_{gas} > P_a$

$P_{gas} = P_a + \rho g h$

$\Delta P = P_{gas} - P_a$

$\Delta P = \rho g h \ (N/m^2)$



$P_{gas} < P_a$

$P_{gas} = P_a - \rho g h$

$\Delta P = P_{gas} - P_a$

$\Delta P = -\rho g h \ (N/m^2)$

If the liquid used is mercury then:

$\Delta P = \text{zero}$

$P_{gas} = P_a + h$

$\Delta P = +h \ (\text{Cm Hg})$

$P_{gas} = P_a - h$

$\Delta P = -h \ (\text{Cm Hg})$

Class Sheet

1- If the mercury level in the open arm of a manometer is lower than its level in the arm connected to a reservoir by 20 cm, so given that the atmospheric pressure is 76 cm Hg then the pressure of the gas inside the reservoir in both of the units of cm Hg and bar respectively are……

a) 56 cm Hg , 0.75 bar b) 56 cm Hg , 0.84 bar

c) 61 cm Hg , 0.75 bar d) 61 cm Hg, 0.84 bar

2- A mercury manometer was used to measure the pressure of a gas reservoir. The mercury level in the open arm was higher than in the arm connected to the reservoir by 36 cm, then the pressure of the enclosed gas in:

(Given that: the atmospheric pressure (Pa) = 1.013×10^5 N/m^2 = 0.76 m Hg)

(i) cm Hg equals…………

a) 116 b) 112

c) 106 d) 92

(ii) atm equals…………

a) 1.21 b) 1.39

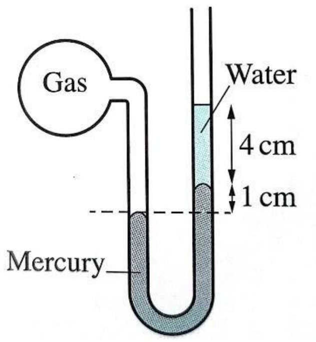
c) 1.47 d) 1.53

(iii) N/n^2 equals ……………..

a) 1.23×10^5 b) 1.41×10^5

c) 1.49×10^5 d) 1.54×10^5

3- The opposite figure shows a manometer while being used to measure the pressure of a gas container, then the pressure of the enclosed gas inside the container equals............

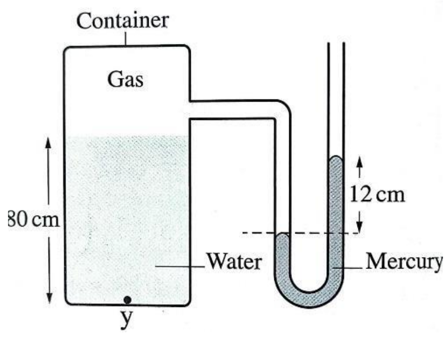


(Given that: ρ_{Hg} = 13600 kg/m^3, ρ_{water} =1000 kg/m^3, Pa = 1.013×10^5 N/m^2 ,g = 9.8 m/s^2)

a) 1.41×10^5 N/m^2 b) 1.03×10^5 N/m^2

c) 1.12×10^5 N/m^2 d) 2.06×10^5 N/m^2

4- In the opposite figure, the pressure at point y is…………



(Given that: ρ_{Hg} = 13600 kg/m^3, ρ_{water} =1000 kg/m^3, Pa = 10^5 N/m^2 ,g = 10 m/s^2)

a) 1.16×10^5 N/m^2 b) 1.24×10^5 N/m^2

c) 2.32×10^5 N/m^2 d) 2.48×10^5 N/m^2

Homework

1- A mercury manometer was connected to a gas reservoir so that the surface of mercury in the open arm was lower than that in the arm connected to the reservoir by 15 cm, then the pressure of the enclosed gas in units of: (where: Pa = 76 cm Hg)

(i) torr equals…………

a) 570 b) 610

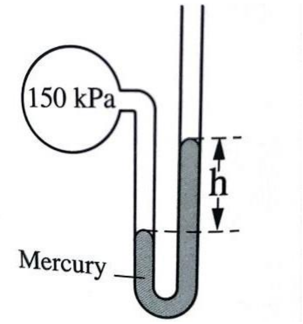
c) 650 d) 760

(ii) bar equals……………

a) 0.75 b) 0.81

c) 0.86 d) 1.19

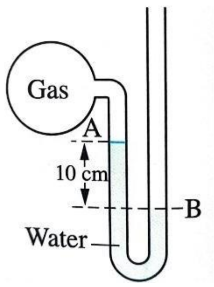
2- In the opposite figure, if the atmospheric pressure is 100 kPa, then the height (h) equals……… (Take ρ_{Hg} =13600 kg/m^3 , g = 9.8 m/s^2)



a) 0.25 m b) 0.28 m

c) 0.375 m d) 0.56 m

3- In the opposite figure, a water manometer is connected to a gas reservoir, then: (Given that: ρ_w = 1000 kg/m^3, Pa = 1.013 × 10^5 N/m^2 , g = 9.8 m/s^2)



(i) The pressure of the gas equals……………

a) 9.5×10^4 N/m^2 b) 9.9×10^4 N/m^2

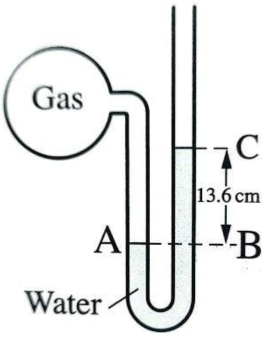
c) 100.32×10^3 N/m^2 d) 102.28×10^3 N/m^2

(ii) The pressure difference between points A, B equals……….

a) 490 N/m^2 b) 980 N/m^2

c) 1950 N/m^2 d) 2300 N/m^2

4- In the opposite figure, a gas container is connected to a water manometer, if the atmospheric pressure in that place was 75 cm Hg, then the enclosed gas pressure equals…………

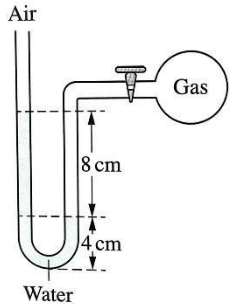


(Given that: ρ_w = 1000 kg/m^3, ρ_{Hg} = 13600 kg/m^3 , g = 9.8 m/s^2)

a) 1.0129×10^5 N/m^2 b) 1.0212×10^5 N/m^2

c) 1.0254×10^5 N/m^2 d) 1.0293×10^5 N/m^2

5- The opposite figure shows a gas reservoir connected to a water manometer, then:



(i) The pressure of the enclosed gas in the reservoir................ **the atmospheric pressure.**

a) less than   b) equals

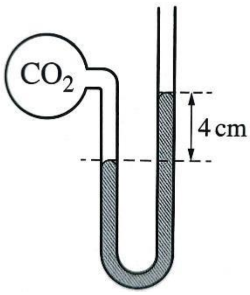
c) greater than   d) answer is indeterminable

(ii) The difference between the pressure of the enclosed gas in the reservoir and the atmospheric pressure is equivalent to the pressure of water column of height…………..

a) 4 cm   b) 6 cm

c) 8 cm   d) 12 cm

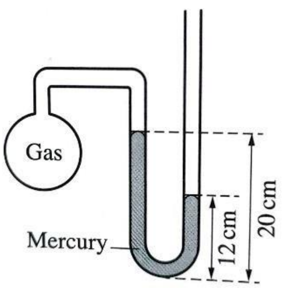
6- The opposite figure shows a mercury manometer connected to a gas container which encloses carbon dioxide, so the pressure of the gas inside the container is….................**(Given that: Pa=76 cm Hg)**



a) 72 torr   b) 80 torr

c) 720 torr   d) 800 torr

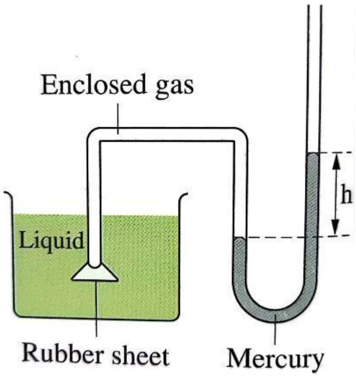
7- In the opposite figure, if the atmospheric pressure is 76 cm Hg. the pressure of the enclosed gas equals………



a) 56 cm Hg   b) 68 cm Hg

c) 84 cm Hg   d) 96 cm Hg

8- In the opposite figure, a manometer is connected to a small funnel whose opening is covered by a rubber sheet and submerged to a certain depth inside a liquid in a container, then the difference between the heights of mercury (h) in the two arms of the manometer increases when.............



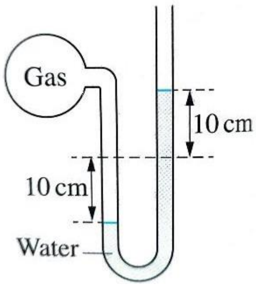
a) increasing the cross-sectional area of the rubber sheet

b) increasing the cross-sectional area of the manometer tube

c) replacing the liquid in the container with another of higher density

d) replacing the liquid in the manometer with another of higher density

9- The opposite figure shows a water manometer while being used to measure the gas pressure inside a container, so the pressure of the gas equals the pressure of a water column of length……….

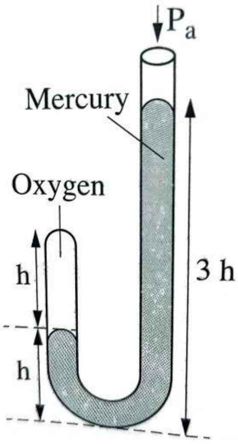


(Where: Pa =75 cm Hg, the relative density of mercury= 13.6)

a) 10cm b) 20 cm

c) 1030 cm d) 1040 cm

10- The opposite figure represents a mercury manometer containing an amount of oxygen gas above the mercury surface in its closed short arm. If the atmospheric pressure is equivalent to h cm Hg, then the pressure of the enclosed oxygen gas equals…………..



a) one time and a half as the atmospheric pressure

b) two times as the atmospheric pressure

c) two times and a half as the atmospheric pressure

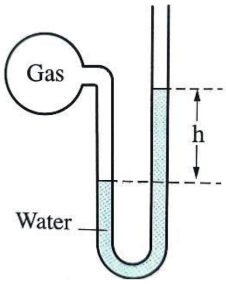
d) three times as the atmospheric pressure

11- A mercury manometer is connected to a thermally isolated gas reservoir in which the pressure of the enclosed gas is higher than the atmospheric pressure at the Earth's surface If that manometer is transferred to the top of a mountain, then the height difference of the mercury levels in the arms of the manometer…………

a) vanishes b) increases

c) decreases d) doesn't change

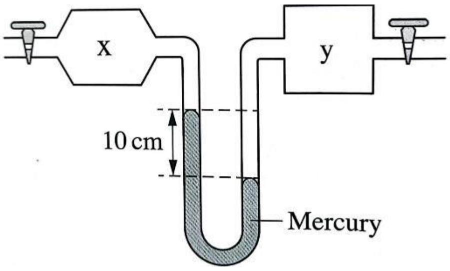
12- A water manometer is used to measure the pressure of an enclosed gas in a container as shown in the figure. If mercury is used instead of water, then the height h……….



a) increases b) decreases

c) remains unchanged d) vanishes

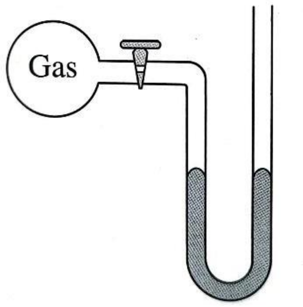
13- In the opposite figure, if the gas pressure in reservoir (x) equals 76 cm Hg, then the gas pressure in the reservoir (y) equals..................



a) 66 cm Hg b) 76 cm Hg

c) 96 cm Hg d) 86 cm Hg

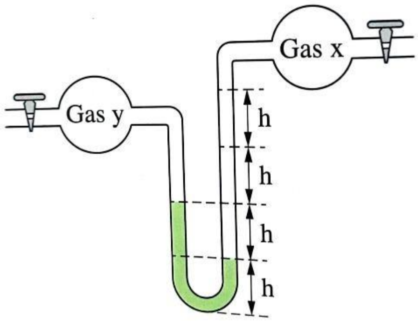
14- The opposite figure represents a mercury manometer of uniform cross-section connected with one arm to a container closed by a valve and enclosing a gas under a pressure of 60 cm Hg, given that the atmospheric pressure is 76 cm Hg, so when the valve gets opened, the level of mercury in the open arm of the manometer will…………….



a) decrease by 16 cm b) increase by 8 cm

c) decrease by 8 cm d) increase by 16 cm

15- The opposite figure shows a mercury manometer containing a liquid of density ρ while each of its arms is connected to a reservoir containing different gas (x, y) then the pressure of gas x compared to that of gas y is…………….



a) higher by ρgh b) lower by ρgh

c) lower by 3 ρgh d) higher by 3 ρgh

Pascal's Principle

Pascal's principal

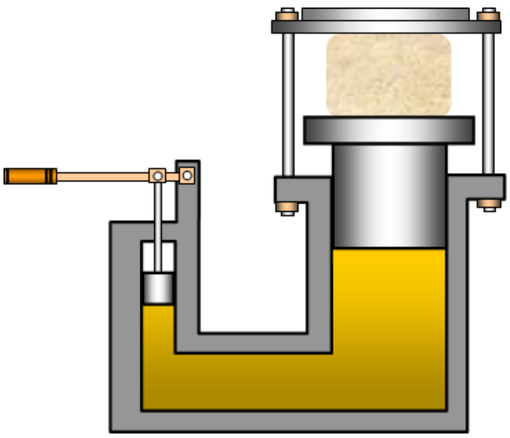
When Pressure is applied on a liquid enclosed in a container, the pressure is transmitted in full to all parts of the liquid as well as to

★**G.R: Liquids obey Pascal's principle while gases don't obey it.**

➡ **Because Liquids are incompressible while gases can be compressed.**

★**Applications on Pascal's principle:**

1) The hydraulic press

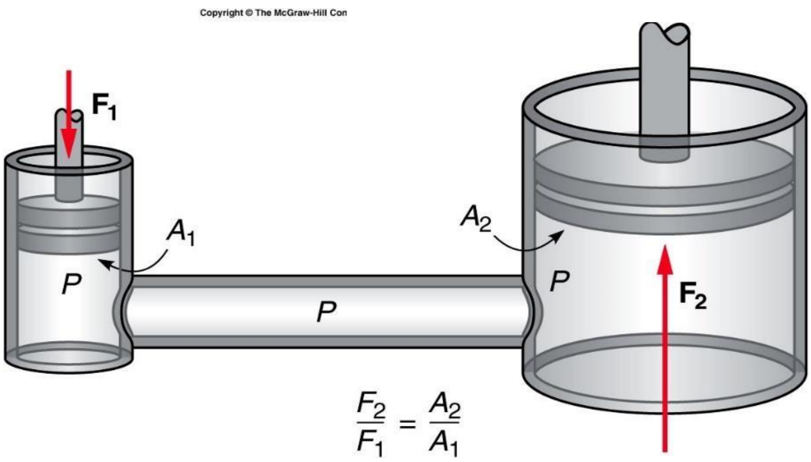


2) The hydraulic brakes of the car

3) The hydraulic lift

4) Chair of the dentist

★ The hydraulic press:



-Uses:

Lifting high loads using a small force.

-Idea of working:

Based on Pascal's principle.

★When a force (f) is acted on the small piston, pressure (p) is produced and transfers completely to the lower surface of the big piston through the liquid where:

$$\boxed{P = \frac{f}{a} = \frac{F}{\ }}$$

★ If the force (f) moved the small piston a distance (y_1) the big piston affected by a force (F) that moved it a distance (y_2)

∴The work done on the small piston = The work done on the big piston.

∴ $fy_1 = Fy_2$

$$\boxed{\therefore \frac{F}{f} = \frac{y_1}{y_2}}$$

The mechanical advantage (η)

It is the ratio between the force produced at the big piston and the acting force at the small piston.

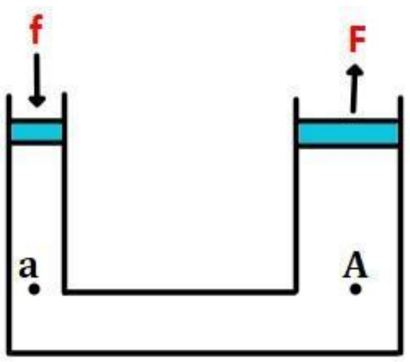
$$\eta = \frac{F}{f} = \frac{A}{a} = \frac{R^2}{r^2} = \frac{D^2}{d^2} = \frac{y_1}{y_2} = \frac{V_1}{V_2}$$

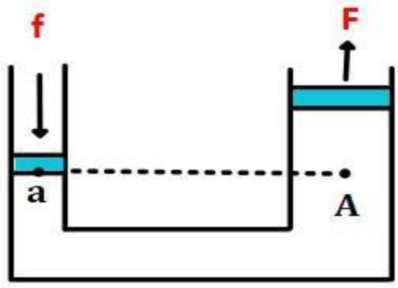
- R ➡ radius of big piston. – d ➡ diameter of small piston

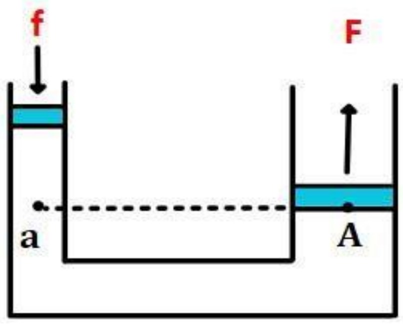
- r ➡ radius of small piston. - V_1 ➡ speed of small piston.

- D ➡ diameter of big piston. – V_2 ➡ speed of big piston.

*Cases of hydraulic press







$P = \frac{f}{a} = \frac{F}{A}$

$P = \frac{f}{a} = \frac{F}{A} + \rho g h$

$P = \frac{f}{a} + \rho g h = \frac{F}{A}$

★ **Efficiency of the hydraulic**

Ratio between the work done at the big piston to the work done at the small piston.

Efficiency of hydraulic press $= \frac{Fy_2}{fy_1}$

★**G.R: Efficiency of hydraulic press doesn't reach 100%.**

➡ **Because of:**

1) **Friction between the piston and the walls of the container**

2) **Gas bubbles in the liquid where work is consumed to reduce the volume of the bubbles.**

★ **W.M: The mechanical advantage of a hydraulic press at equilibrium = 400.**

➡ **The ratio between the force produced at the big piston to that acting at the small piston = 400.**

Class Sheet

1- The cross-sectional area of the small piston of a hydraulic press is 10 cm^2 while the cross-sectional area of its big piston is 800 cm^2, so if a force of 100 N is exerted on the small piston, then: (Take: $g=10\ m/s^2$)

(i) The biggest mass that can be lifted by the big piston due to the effect of that force assuming the two pistons are at the same horizontal level is……………..

a) 200 Kg b) 400 Kg

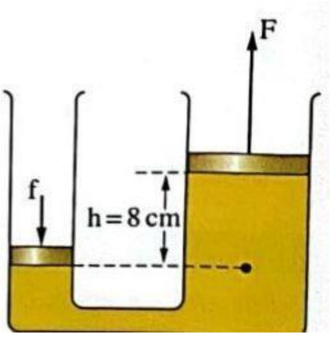
c) 600 Kg d) 800 Kg

(ii) The distance moved by the small piston to move the big piston 1 cm equals…………….

a) 50 cm b) 80 cm

c) 10 cm d) 120 cm

2- The opposite figure shows a hydraulic press that contains an amount of oil of density 800 kg/m^3, the cross-sectional area of its small piston is 10 cm^2 and the cross-sectional area of its big piston is 100 cm^2, if a force of 180 N is applied on the small piston, then (Take: $g= 9.8\ m/s^2$)



(i) The force that is produced at the big piston is..........

a) 6.5×10^3 N b) 1.7×10^3 N

c) 1.8×10^3 N d) 1.9×10^3 N

(ii) The mechanical advantage of the piston is..........

a) 5 b) 10

c) 15 d) 20

3- A hydraulic lift has two pistons whose radii are 4 cm, 60 cm. If an additional pressure of 8.48 $\times 10^4\ N/m^2$ affects the small piston, then the biggest mass that can be lifted by the big piston so that the two pistons become at the same horizontal level, equals.........

a) 4.797×10^3 Kg b) 9.595×10^3 Kg

c) 47.97×10^3 Kg d) 95.95×10^3 Kg

Homework

1- On which of the following materials Pascal's rule is applicable if the material fills a closed system?

a) Mercury b) Sand c) Iron filings d) Hydrogen

2- The hydraulic presses that work according to Pascal's principal are used for amplifying the…….

a) pressure b) work done c) force d) velocity

3- In the ideal hydraulic press, if the ratio between the radii of the two pistons is $\frac{8}{3}$, the ratio between the work done due to the motion of the big piston to that of the small piston is……

a) $\frac{3}{8}$ b) 1

c) $\frac{8}{3}$ d) $\frac{64}{9}$

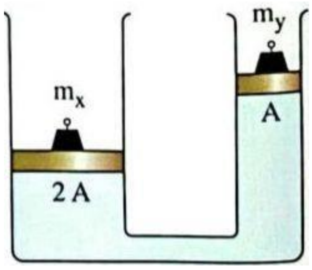
4- In the hydraulic press, the ratio between the force produced at the big piston to that exerted on the small piston when the two pistons balance in one horizontal level is…………

a) greater than one b) less than one c) equal to one d) indeterminable

5- When exerting a force on the small piston of a balanced hydraulic press, the ratio between the displacement of the small piston to that of the big piston in the hydraulic press will be…….

a) greater than one b) less than one c) equal to one d) indeterminable

6- An ideal hydraulic press has two pistons of cross-sectional areas A, 2 A that are balanced as in the opposite figure. If the mass on its small piston is m_y and that on its big piston is m_x, then……



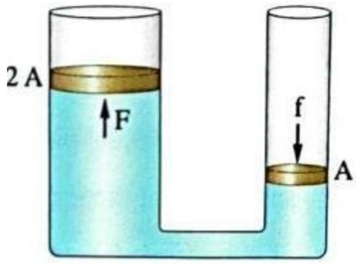
a) $m_x < m_y$ b) $m_x = 2m_y$

c) $m_x < 2m_y$ d) $m_x > 2m_y$

7- If the cross-sectional area of the big piston in a hydraulic press is double that of the small piston, so at the motion of the hydraulic press, the ratio between the volumes of the displaced liquid downward in the small piston cylinder to the displaced liquid upward in the big piston cylinder is………

a) $\frac{1}{2}$ b) $\frac{1}{1}$ c) $\frac{2}{1}$ d) $\frac{1}{4}$

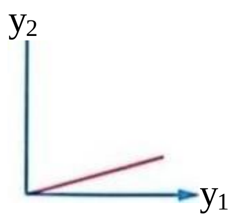
8- In the opposite figure, the ratio of the pressure at the big piston to the pressure at the small piston is………



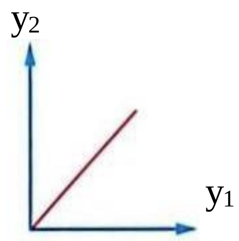
a) $\frac{1}{2}$ b) $\frac{1}{1}$

c) $\frac{2}{1}$ d) indeterminable

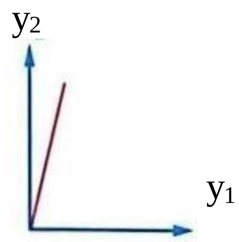
9- Which of the following graphs represents the relation between the magnitude of the big piston displacement y_2 and that of the small piston y_1, in a hydraulic press when the two quantities are plotted in the same scale?



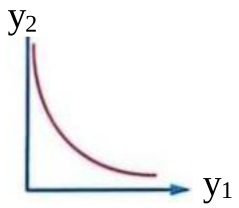
(a)



(b)



(c)



(d)

10- If the ratio between hydraulic press pistons' radii is $\frac{5}{1}$, the ratio between the pressure at the small piston to the pressure at the big piston, when they are balanced in the same horizontal level is……….

a) $\frac{1}{5}$ b) $\frac{5}{1}$

c) $\frac{1}{1}$ d) $\frac{25}{1}$

11- If the ratio between the radii of the two pistons of a hydraulic press is $\frac{5}{2}$, so the mechanical advantage of the press equals………..

a) $\frac{5}{2}$ b) $\frac{25}{4}$

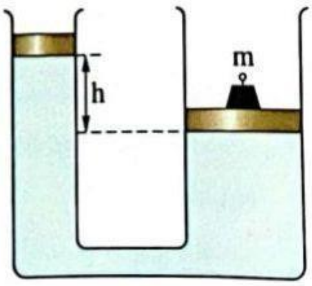
c) $\frac{2}{5}$ d) $\frac{4}{25}$

12- If the mechanical advantage of a hydraulic press equals 250 and the cross-sectional area of the small piston is 2.5 cm^2, the radius of the big piston equals………

a) 14.1 cm b) 100 cm

c) 198.81 cm d) 625 cm

13- A hydraulic press contains a liquid of density ρ, if its pistons that have cross-sectional areas of A and 3 A are balanced as in the figure, then the value of mass m on the big piston is calculated from the relation ………..



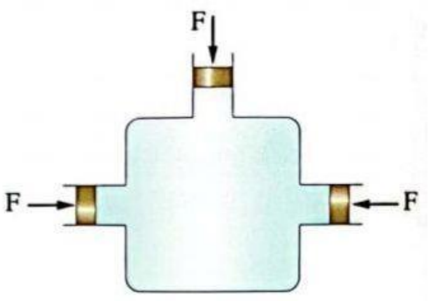
a) m = ρhA

b) m = 2 ρhA

c) m = 3 ρhA

d) m = 4 ρhA

14- The opposite figure shows a completely water filled container in a state of equilibrium by means of three identical pistons, each of area A, that are placed at three openings. If additional force of magnitude F acted on each piston at the same moment, then the value of the pressure increase inside the liquid at the center of the container due to the additional force is equivalent to………….



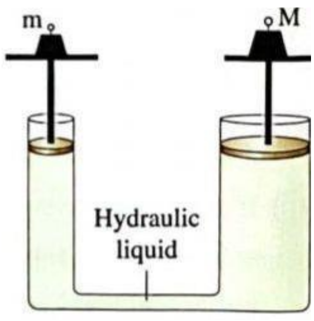
a) $\frac{F}{A}$

b) $\frac{2F}{A}$

c) $\frac{3F}{A}$

d) Zero

15- A hydraulic press has a small piston of cross-sectional area A carrying a load of mass m and a big piston of cross-sectional area 10 A carrying a load of mass M. When the two pistons are balanced in the same horizontal level and by ignoring their masses, then………….



a) M = m

b) M =10 m

c) M =100 m

d) M =150 m

16- The ratio between the radii of the pistons of a hydraulic press was $\frac{5}{1}$. When its two pistons were balanced in the same horizontal level, the force acting on the small piston was 50 N, then:

(Given that: the acceleration due to gravity=10 m/s^2)

(i) The mechanical advantage of the hydraulic press equals…………

a) 2.5

b) 5

c) 25

d) 20

(ii) The largest mass that can be lift on the big piston equals…………

a) 25 Kg

b) 75 Kg

c) 125 Kg

d) 250 Kg

(iii) The distance moved by the small piston if the big one is moved a distance of 1cm equals………

a) 2.5 cm b) 15 cm

c) 25 cm d) 50 cm

17- A hydraulic press has two pistons, the cross-sectional area of the big piston is 10 times that of the small piston. When the two pistons are balanced at the same horizontal level and a force of 100 N is applied on the small piston, the resulted force on the big piston equals …………..

a) 100 N b) 1000 N

c) 2000 N d) 10^4 N

18- A hydraulic press has two pistons of diameters 10 cm, 100 cm, if a force of 800 N is applied on the small piston, then the biggest mass that can be lifted upward by the big piston due to this force, so that the two pistons balance at the same horizontal level is…… ($g = 10\ m/s^2$)

a) 4000 Kg b) 8000 Kg

c) 10 ton d) 12 ton

19- A hydraulic lift in car service station has two pistons of radii 2 cm and 30 cm, so the minimum required force on the small piston to balance the two pistons in the same horizontal level when putting a car of mass 1500 kg on the big piston equals ……… ($g = 9.8\ m/s^2$)

a) 65.33 N b) 130.66 N

c) 195.99 N d) 980 N

20- An ideal hydraulic press has a big piston of radius 0.5 m. When a mass of 10 kg is placed above its small piston, it balances a mass of 5×10^3 kg on its big piston in the same horizontal level, so ………, ………

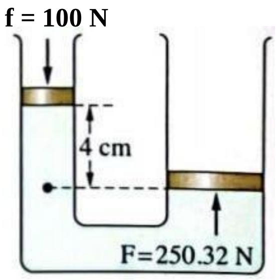
	The mechanical advantage of the press	**The radius of the small piston**
a	500	0.025 m
b	250	0.022 m
c	250	0.025 m
d	500	0.022 m

21- The hydraulic lift in a car service station uses compressed air to exert a force on its small piston that has diameter 2 cm, so if the diameter of its big piston is 32 cm, then the required air pressure to lift a car of mass 1800 kg equals……. ($g = 10\ m/s^2$)

a) $2.24 \times 10^5\ N/m^2$ b) $1.5 \times 10^6\ N/m^2$

c) $5.6 \times 10^5\ N/m^2$ d) $6.22 \times 10^6\ N/m^2$

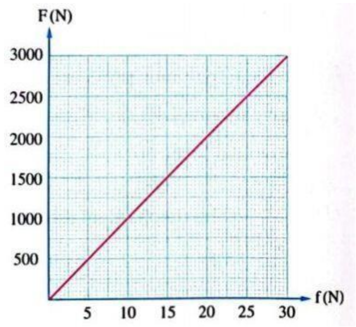
22- The opposite figure shows a hydraulic press in equilibrium. If the cross-sectional areas of its pistons are $10\ cm^2$ and $4\ cm^2$, so the density of the hydraulic fluid is …………($g = 10\ m/s^2$)



a) $720\ Kg/m^3$ b) $800\ Kg/m^3$

c) $980\ Kg/m^3$ d) $1250\ Kg/m^3$

23- The opposite graph shows the relation between the produced force on the big piston (F) and the applied force on the small piston (f) for a hydraulic press when its two pistons are at equilibrium in the same horizontal level, so:



(i) **The mechanical advantage for the press is …………..**

a) 50 b) 100

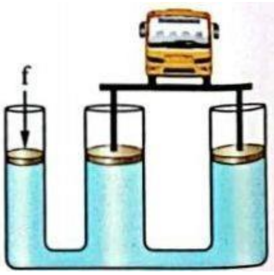
c) 150 d) 500

(ii) **If the radius of the small piston is 5 cm, the radius of the big piston is…………**

a) 25 cm b) 37.5 cm

c) 42.5 cm d) 50 cm

24- Two pistons that are used for lifting a bus of mass 3 tons, the area of each is $0.1\ m^2$, are connected to a third piston acted upon by a force of 200 N. If the three pistons are balanced in the same horizontal level, then the area of the third piston equals................($g = 10\ m/s^2$)



a) $3.325 \times 10^{-4}\ m^2$ b) $6.65 \times 10^{-4}\ m^2$

c) $1.33 \times 10^{-3}\ m^2$ d) $2.66 \times 10^{-3}\ m^2$

المراجعة رقم (3)

اختبار شهر مارس

Applications of Pressure of a point inside a liquid

Connceted vessels – u shaped tube – mercury barometer – manometer

1)connected vessels :

Shape :

A container cosist of many vessels of a different geometrical shapes connected together

Working idea :pressure at all points on the same horizontal level are equal

P(a)=p(b) =p(c)=……….

2) u shaped tube:

Shape : u shaped tube

Working idea :pressure at all points on the same horizontal level are equal

Uses:1)determine the density of a liquid by knowing the density of another liquid

2)comparing the density of 2 immiscible liquids

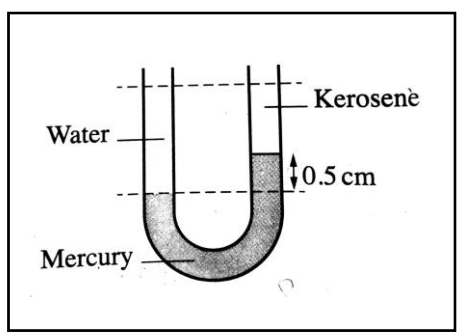
3)determine the relative density

Q1:

the oppsite figure shows a u shaped tube containing three immiscible liquids at equilibrium , then the height of water column equals …………

(*ρ*

a)17.2 b)24 c)32 d)36



Q2:

A u shaped tube contains an amount of water of density , then an amount of oil of density is poured in one of its arms , if the height of oil column is 10 cm , the height of water column above the level of the interface with water which balances the oil's column is ………………

a)7.58 cm b)7.85 cm c)8.75cm d)9.25cm

Q3:

A u shaped tube contains an amount of water of density after pouring oil in one of its 2 branches the height difference between the water surface in the 2 branches becomes 19 cm , then if the oil density is 800 kg/m^3, the height of oil equals …….

a)21.25 cm b)21.75cm c)22.5cm d)23.75 cm

"measuring pressure "

Mercuric brometer:

Structure :1.a glass tube with uniform cross section with height 1 m .opened at one end .

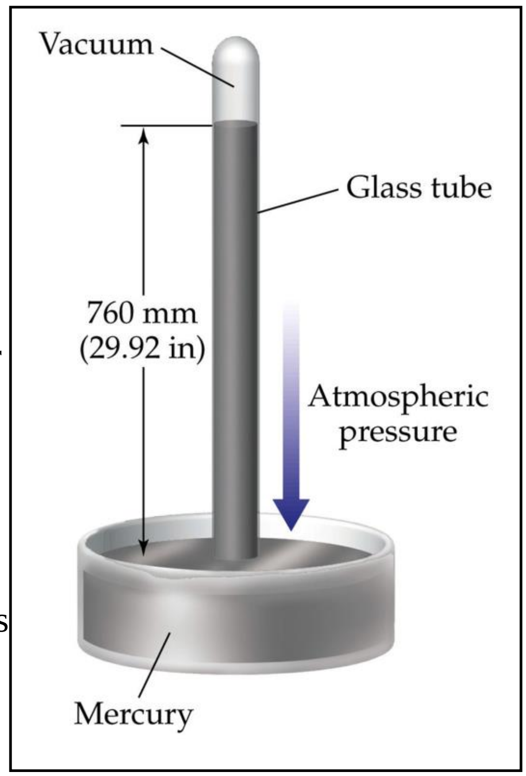
2.a basin of suitable volume .

3.a suitable amount of mercury .

(torricellian vacuum :the space above the column of mercury in the tube evacuated except a small amount of mercury vapor

Working idea :pressure at all points on the same horizontal level are equal

(the standard atmospheric pressure :the weight of the weight column whose base is a unit area and its height extends from the sea level to the top of the atmosphere at **0C)**



The factors affecting the atmospheric pressure:

1.the height of the sea level

2. the average density of the atmospheric air

3.temperature

4.acceleration due to gravity

Uses of Mercuric brometer:

1.Measuring the atmospheric pressure in

2.determine the height of the mountain or a building

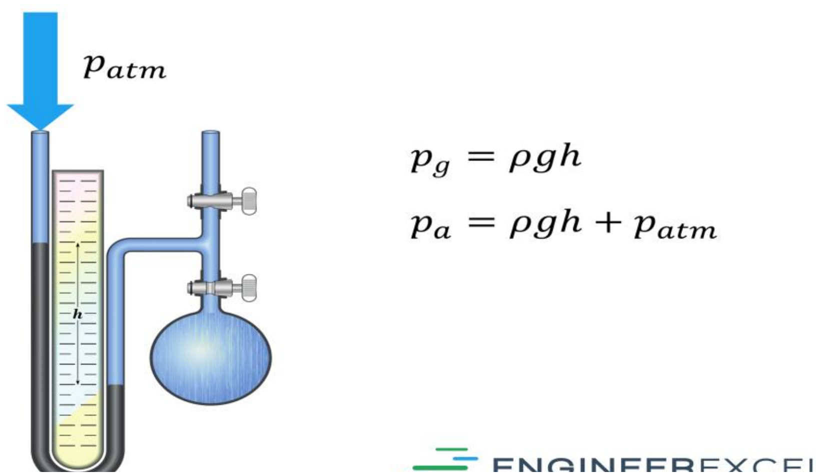
$$\boldsymbol{g}(\boldsymbol{h} \qquad)$$

Atmosphere :

mHg 0.76 cmHg 76 mmHg (torr) 760

pascal ($\boldsymbol{N}$) bar 1.013

Manometer :



<u>Structure</u> :U shaped tube of uniform cross section containing proper amount of liquid of unknown density

<u>Types :</u>1.water manometer

2.mercury manometer

Working idea :pressure at all points on the same horizontal

level are equal

uses :1.measuring the difference between the pressure of an enclosed gas and the atmospheric pressure
2.measure the pressure of an enclosed gas by knowing the atmospheric pressure

Equation: Change in Pressure of a Liquid Column Manometer

The equation used to relate the change in pressure to change in height in a manometer is$\Delta P=\rho g\Delta h$,where ΔP is the difference in pressure, ρ is the density of the fluid, g is the force due to gravity (9.81 m/s^2 for Earth), and Δh is the difference in height.

notes

- The equation used to relate change in pressure and change in height of a liquid column manometer is$\Delta P=\rho g\Delta h$.where ΔP is the difference in pressure, ρ is the density of the fluid, g is the force due to gravity, and Δh is the difference in height.
- In a liquid column manometer, the ratio of change in height is equal to the ratio of the change in pressure.

Example 1: Bar to Pascal Conversion

A bar is a unit that is defined as being equal to 10^5 Pa.Convert a pressure of 0.48 bar to a pressure in pascals.

a.4.8×1 b.4.8×1 c.4.8×1 d.4.8×1 e.4.8×1

Answer

1bar=100000. Pa

100000*0.48=48 000

0.48 bar is 48 000 pascals,equivalent to 4.8×10^4.

The correct answer is E.

Example 2: Torr Conversions

A torr is a unit that is defined as being equal to the pressure produced by 1 mmHg.

1.Convert a pressure of 455 torr to a pressure in pascals.

a.6.06×1 b.4.55×1 c.6.37×1 d.6.19×1 e.6.06×1

2.Convert a pressure of 455 torr to a pressure in bar.
a.0.606 bar b.4.55 bar c.6.37 bar d.0.637 bar e.0.619 bar

Answer

Part 1

1 atm = 760 torr

1 atm = pascal **1.**

pascal =760 torr

6.06×10^4 The answer is E.

Part 2
1 bar =100000 pascal

which means 455 torr in bar is 0.606 bar.The answer is A.

- **Notes**
- The equation to describe the pressure of a liquid or gas is $P=\rho gh$, where P is the pressure, ρ is the density of the fluid, g is the force due to gravity, and h is the height.
- A column of mercury can be used to measure atmospheric pressure.
- 1 atm = 101 325 Pa = 1.01 bar
- 1 atm = 760 mmHg = 760 torr

Applications of pressure measuring pressure :

1.Measuring blood pressure .

2. Measuring the air pressure inside the car tyres .

Q1:

A bar is a unit that is defined as being equal to 10□ Pa.Convert a pressure of 0.48 bar to a pressure in pascals.

a.4.8×10^5 Pa   b.4.8×1   Pa   c.4.8×1   Pa   d.4.8×1   Pa   e.4.8×10^4 Pa

Q2:

A torr is a unit that is defined as being equal to the pressure produced by 1 mmHg.

Convert a pressure of 455 torr to a pressure in pascals.

a.6.06×10^4 Pa   b.4.55×10^5 Pa   c.6.37×10^3 Pa   d.6.19×10^4 Pa   e.6.06×10^5 Pa

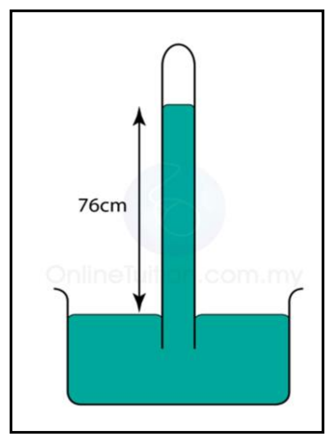
Convert a pressure of 455 torr to a pressure in bar.

Q3:

The apparatus shown in the diagram is used to measure atmospheric

pressure. Which of the following occupies region A of the test tube?

a.Water vapor   **b.**Vacuum   c.Glass   **d.**Air



Q4:

An atmosphere is a unit that is defined as being equal to 1.013×10^5 Pa.

Convert a pressure of 0.444 atm to a pressure in pascals.Give your answer in scientific notation to two decimal places.

a.4.50×10^4 Pa   b.4.44×10^5 Pa   c.4.50×10^5 Pa   d.4.44×10^4 Pa   e.1.47×10^5 Pa

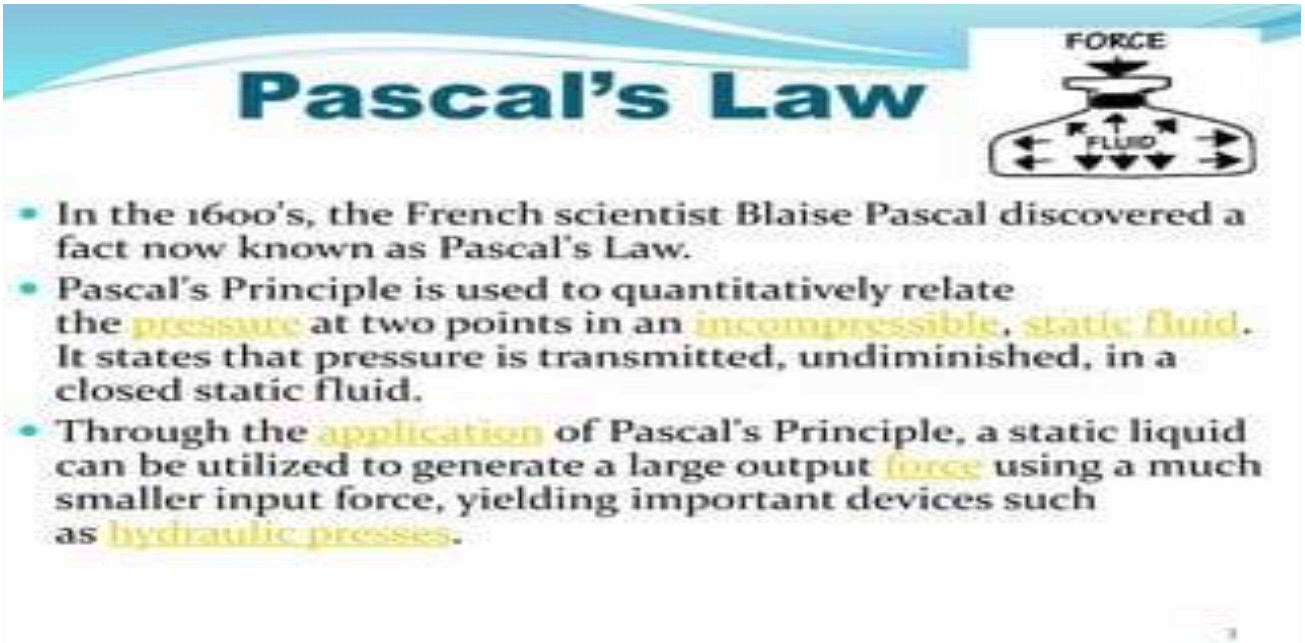
Convert a pressure of 0.444 atm to a pressure in bar.Give your answer to three decimal places.

Q5:

Find the total pressure at the base of a column with a vertical height of 2.55 m containing a liquid of density 1,150 kg/m^3.The top of the column is at sea level. Use a value of 101.3 kPa for the atmospheric pressure on the column.

a.1.01×10^5 Pa   b.0.287×10^5 Pa   c.1.04×10^5 Pa   d.0.726×10^5 Pa   e.1.30×10^5 Pa

Pascal's principle



p

The Pressure on an Area and the Force Acting on the Area

The pressure p on an area A is given by$p$=FA,where F is the component of the force acting perpendicularly to the area

Pascal's Principle

Pascal's principle states that at a point within a fluid, the pressure at that point is equal in all directions.

This has two implications for forces acting at the point:

- The force exerted on the point by the fluid is the same in every direction.
- The force exerted on anything that is in contact with the point is the same in every direction.

The Forces on the Ends of a Pipe and the Cross-Sectional Areas of the Ends of the Pipe

For a pipe that has equal pressure at its ends, the magnitudes of the forces acting at the ends are related to the cross-sectional areas of the ends by the equation $\frac{1}{} = \frac{2}{}$ where$F1$ and $F2$ are the magnitudes of the forces acting on the ends of the pipe and $A1$ and $A2$ and are the cross-sectional areas of the ends of the pipe.

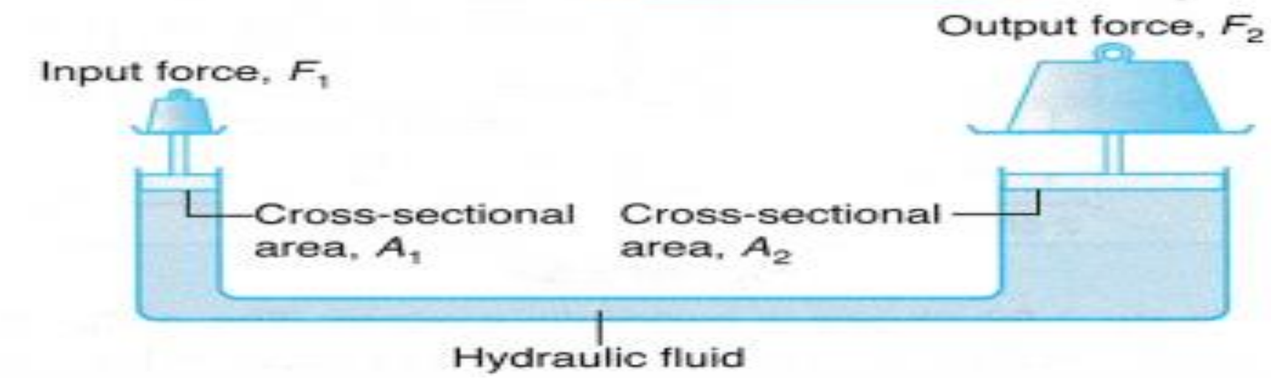
Applications of Pascal's Principle

1.hydraulic press :

$$P_1 = P_2, \text{ but, } P_1 = \frac{F_1}{A_1} \text{ and } P_2 = \frac{F_2}{A_2}.$$

Therefore,

$$\boxed{\frac{F_1}{A_1} = \frac{F_2}{A_2}}$$



Structure :a tube equipped with 2 pistons at its ends , a small one of cross sectional area a , and another big one A , the space between them filled with liquid (hydraulicliquid)

Uses:obitain a large force on the big piston using a small force

Working idea :Pascal's Principle.

Mechanica advantages :

$$\frac{A}{} \quad \frac{}{} \quad \frac{}{}$$

Effeciency of the hydraulic press :

$$\frac{he\ work\ don \qquad he\ big\ pist}{he\ work\ done \qquad he\ small\ piston} \qquad \frac{Fy}{}$$

Example 1: on hydraulic press

The cross sectional area of the small piston of a hydraulic press is 10 cm2 . while the cross sectional area of the big piston is 800cm2 , so if a force is exerted on the small piston , then

1.what is the biggest mass can be lifted by the big stone due to the effect of that force assumingthe 2 pistons are at the same horizontal level .

2.find the distance moved by the small piston to move the big pistion

Answer :

Part 1.

$- \quad - \qquad F \quad —$

Part 2.

$Fy \qquad —$

Q1:

On which of the following material pascal's rule is applicable if the material fills a closed system

a.mercury b.sand c.iron fillings d.hydrogen

Q2:

The hydraulic press that work according to pascal's principle are used for amplifying the ….

a.pressure b.work done c.force d.velocity

Q3:

A bag attached to an intravenous drip holds saline solution that has a density of 2,160 kg/m^3.The bag is 15 cm in height and full to the top. The solution flows from the drip through a hole of area 0.785 cm^2 and passes through the tube into a cannula that has an opening of area 0.0225 cm^2.

What is the magnitude of the force exerted by the saline solution at the hole at the base of the drip bag? Give your answer to two decimal places.

What is the magnitude of the force exerted by the saline solution at the cannula? Give your answer to three decimal places.

كيفية طباعة صفحات معينة من ملف معين

مثلا ازاى نطبع الصفحات من صفحة 4 الى صفحة 9